Docket No.: 361752002900
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Tien-Kuei SU et al.

Application No.: 10/690,709 | Confirmation No.: 9764

Filed: October 23, 2003 | Art Unit: 1773

For: MULTI-LAYER BARRIER FILM STRUCTURE | Examiner: L. B. Kiliman

DECLARATION OF KEUNSUK P. CHANG

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Keunsuk P. Chang declares under penalty of perjury under the laws of the United States of America as follows:

1. I am a citizen of the United States of America, residing at 31 Mayflower Ct., North Kingstown, RI 02852, USA. I am one of the inventors of this application and I am familiar with the invention as described and claimed in the specification of this application. I received a Bachelor's degree in Chemical Engineering in 1983 from Princeton University and a Master's degree in Chemical Engineering from the University of Connecticut in 1985. After graduation, I worked at Mobil Chemical Company Films Division until 1995, working in various assignments in product development and manufacturing. In September 1996, I joined Toray Plastics (America), Inc. and have been at Toray Plastics (America), Inc. in product development

since. Currently I am Product Development Manager for the Torayfan Division of Toray Plastics (America), Inc.

2. I have reviewed the Office Action of February 27, 2006, and would like to provide some additional information and data that distinguishes our invention from that of Beckerdite (U.S. Pat. No. 6,589,621). Beckerdite does not disclose or suggest applying the polyhydroxy amine ether (PHAE) polymer onto a polyolefin-containing layer *having a functional group* as recited in amended claim 1 and other independent claims in the application. A functional group onto a polyolefin containing layer could be created, for example, by discharge treatment of the polyolefin-containing layer. Nowhere, not even in the descriptions of PHAE laminate structures in column 5 & 6 and in the Examples, does Beckerdite disclose or suggest discharge treatment of the polyolefin substrate of Beckerdite. Particularly in the case of solution coating the PHAE polymer onto a polyolefin substrate such as a biaxially oriented polypropylene film (BOPP), discharge-treatment of the PHAE coating receiving layer or surface of the polypropylene ensures adequate adherence of the PHAE polymer to the polypropylene film surface. Without this kind of treatment, the PHAE polymer will have very poor adhesion to the film surface. This is due to the difficulty recognized by Applicants in trying to bond dissimilar materials: in this case, PHAE -- which is a very polar polymer -- to polypropylene, a very non-polar polymer. Applicants recognized this problem and arrived at a solution by modifying the polypropylene surface by discharge treatment to promote bonding of a polar material such as PHAE to the non-polar polypropylene. Discharge-treatment of the polyolefin-containing layer of the embodiments of the invention grafts polar oxygen-bearing and/or nitrogen-bearing functional species to the surface of the polyolefin-containing layer and thus, raises the surface energy of the film which allows a polar aqueous solution of PHAE to wet-out and adhere to the polypropylene substrate. Good adhesion of the PHAE layer to the polypropylene layer provides, in turn, excellent gas barrier properties. Applicants found that if

adhesion is poor, the PHAE will essentially flake-off or peel-off easily, resulting in significant loss of gas barrier properties.

3. The following data in Table 1 was produced by coating sheets of discharge-treated and non-discharge-treated biaxially oriented polypropylene (BOPP) films with a PHAE solution of the type described in the pending application. These coated sheets were then dried in an oven and tape tests conducted to measure the degree of adhesion. (These tests are also described in the specification of the pending application in paragraph [0042] to [0046]..)

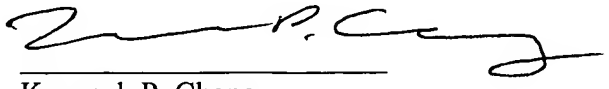
Table 1

Sample	Wetting Tension (dynes/cm)	PHAE Adhesion (% peel-off)
Treated BOPP	41	0
Untreated BOPP	<32	100

* Wetting tension of untreated BOPP is generally ca. 30-32 dynes/cm. Generally, for adequate wet-out and adhesion of the PHAE coating to BOPP, a minimum of 36 dynes/cm is required.

Table 1 shows that when PHAE coating is applied to an untreated BOPP film and dried, the resulting adhesion of the PHAE to the BOPP surface is poor. Applying 3M's 610 adhesive tape to the PHAE layer virtually strips off all of the PHAE. In comparison, when applying the PHAE coating to a treated BOPP surface, the adhesion is excellent, with virtually no PHAE peeling-off with the same tape test. In short, the polyolefin-containing (BOPP) layer *having a functional group* as recited in amended claim 1 produced unexpectedly good adhesion with the PHAE coating versus a BOPP layer without the functional group.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed at North Kingstown, RI, USA, this __24th___ day of _____May_____, 2006.



Keunsuk P. Chang